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ABSTRACT

This paper presents the findings of a study on the use of World Wide Web among students at St. Cloud State University, Minnesota, USA. The paper explores problems and challenges on campus Web computing and the relationships among the extent of Web usage, class level, and overall student academic performance. Specifically, the purposes of this study are: to identify campus Web related problems from the students' perspective; and to conduct a preliminary investigation into the relationships among students' computer skills, frequency of reported Web related problems, student performance (GPA). The paper concludes with a discussion on improving the effectiveness of campus Web services. Two tables include: internet usage responses and frequency of reported problems. The Web survey is appended. (Contains 6 references) (Author/AEF)

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UNIVERSITY INTERNET SERVICES: PROBLEMS AND OPPORTUNITIES

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ABSTRACT

This paper presents the findings of a study on the use of World Wide Web pages among students at St. Cloud State University, Minnesota, USA. The paper explores problems and challenges on campus Web computing and the relationships among the extent of Web usage, class level, and overall student academic performance. The paper concludes with a discussion on improving the effectiveness of campus Web services.

INTRODUCTION

The rapid advance of Web based technology has created a major challenge to Universities and Colleges in classroom teaching. It changed the nature of information technology service used in education (Hong, 1997). At the end of the 1990s paperless classrooms began to emerge at many colleges and universities (Bialac and Glover, 1997). The academic world has seen an enthusiastic rush of faculty to the WWW as the new mode of interaction with students. Syllabi, projects, handouts, and tutorials even entire course and curriculum are placed on the Web not only as a new mode of distance learning but also as a supplement to traditional mode of face-to-face classroom instruction. According to a recent survey of campus officials and IT managers across the United States, more than one-fourth (28%) of college courses are supported by a Web page, and thirty-nine percent of all courses are using Internet resources as part of the course requirements (Nelson, 1999).

The increased use of Web technology as a tool for instruction and research by faculty and students creates challenges and problems for academic computing management. Schools are facing challenges of upgrading and expanding computing facilities. Faculty support and instructional integration have become the most important IT functions in recent years (Thiele, 1999). The problems that affect student effective learning include lack of knowledge on how to use computers, unstable technology in use, slow Web access speed, lack of available hardware and software among others. Ultimately, to improve effectiveness and maximize the benefits of Internet usage in education, solutions are needed to minimize these problems and to increase the satisfaction of faculty and students who use the Web technology.

The purposes of this study are (1) to identify campus Web related problems from student perspective (2) to conduct a preliminary investigation into the relationships among student computer skills, frequency of reported Web related problems, student performance (GPA). It is hoped that the study results will help us understand the types of Web related problems that college students experience, the factors might contribute to the difficulties, and whether frequency of Web usage is related to student overall performance. The paper is organized as follows. After a review of current issues in university Internet services, a brief descriptions of the

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computing facilities of the two campuses in the study are provided. Then research methodology and findings are discussed. The paper concludes with a summary and some suggestions for improving campus Internet services.

CURRENT ISSUES IN UNIVERSITY INTERNET USAGE

Technology resources like e-mail, FTP, the World Wide Web (WWW), and multimedia are increasingly common components of the instructional experience for college students. Additionally, growing numbers of campuses now have a computer competency or computer instruction requirement for all their undergraduate students. According to the Kenneth C. Green (1997), visiting scholar at the Center for Educational Studies at Claremont Graduate University, "Technology resources are becoming an increasingly important component of the instructional experience, across all fields and all types of institutions." The use of information technology (IT) as an instructional resource is highest in research universities. However, Green notes that the gains have occurred in all types of colleges and universities: "Although students in universities are more likely to encounter IT resources in their classes than their peers at four-year colleges or community colleges, the survey data document the expanding use of IT resources across all sectors of American higher education."

Seemingly endless streams of Internet users present problems of traffic control and overall accessibility. Already, the Internet is frequently overloaded with electronic messages. Demand for ever larger e-mail volume, multimedia content, real time broadcasting, electronic meetings, download of free software, music, and games, and a host of developing technologies and applications will continue to tax the existing infrastructure of US colleges and universities. Brownouts and overloaded networks are increasingly common as traffic on the Internet continues to grow faster than bandwidth capabilities. For colleges with limited budgets and computing resources, keeping up with the increasing demand by bandwidth hungry students for Internet access is particularly difficult. Computing resources at college and universities often lag behind the increase in web access from students.

This situation has not gone unnoticed. The recent survey of chief academic computing officers respondents by The Campus Computing Project (1999) also identified "assisting faculty integrate IT into instruction" and "providing adequate user support" as the top IT challenges confronting their institutions. Almost 40% of institutions identified "instructional integration" as the single most significant IT issue in their institutions, followed by 28% citing "providing adequate user support." IT financial planning for replacing aging hardware and software ranked third at 14%.

INTERNET ENVIRONMENT AT ST. CLOUD STATE UNIVERSITY

St. Cloud State University (SCSU) is a comprehensive university located about 65 miles northwest of Minneapolis/St. Paul Minnesota. The University consists of seven colleges and a graduate school and offers over 60 baccalaureate degrees, several masters degrees, and one doctoral program . St. Cloud State University currently serves a student population of 14,000 and has approximately 1000 employees. Class rooms, computing laboratories, departmental and faculty offices, and dormitories are all wired into the fiber optic based campus network. As with most colleges and universities demand for Internet services at St. Cloud State University has increased dramatically within the past few years.

St. Cloud State University is served by MNET, which provides Internet services to Minnesota government agencies and educational institutions. A T1 communications line connects St. Cloud State University to the regional Internet hub in St. Paul. Hundreds of computers on campus are cabled directly into the campus network via Ethernet adapters. Token Ring LANs connect buildings and laboratories on campus. A bank of 330 high speed modems provides dial-up access to the University network.

While there have been numerous discussions over the years, there are currently no university-wide standards for desktop hardware, operating systems, applications software, Web browsers, or email packages. However, good support is available for the most popular configurations and applications those who choose to deviate from the "beaten path generally find themselves without support. Most of the open computing laboratories are maintained by Academic Computing Services, the others are maintained by department or college.

Centrally, the University maintains two general usage multiprocessor Digital Equipment Corporation Alpha class (one runs the VMS operating system; the other runs

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UNIX) email and Web servers. Both machines are available for faculty and students e-mail and Internet usage. Basic user training in e-mail operations, web surfing and home page development is provided at no cost to students and faculty by Academic Computing Services; advanced training is provided through numerous courses offered by various departments across campus, primarily to their own major and minor students. For maximum flexibility and control, many departments now maintain their own (primarily Windows NT 4.0) servers, which are also connected to the campus topology. A few individual faculty members have installed server software on their own computers allowing students to access files and Web pages directly from machines in the faculty member's office.

Many of the needed Web development tools are readily available to faculty and students: a variety of plain text and HTML editors, Front Page, Java Script authoring tools, and Java compilers. An open multimedia lab offers digital capture, production, and editing capabilities.

METHODOLOGY

Study Design

The study is designed to proceed in three steps: (1) identify major problems, (2) analyze the frequency of the problems, (3) test hypotheses.

Null Hypotheses

Based on common pedagogical knowledge that web pages can be effectively used in teaching at colleges and universities, the following null hypotheses (Ho) are formulated:

1. Class level does not influence the frequency of weekly web accesses. We commonly believe that the higher the class level, the higher the needs to access the web for class projects and research.

2. Frequent visit to the web does not have impact on GPA and vice versa. Frequent Web usage may either help students' performance or decrease students' performance, depending on what the students use Web for. Spending time on Web for playing games and chatting will negatively affect students' performance. On the other hand, students who use Web for researching term papers and looking for references and online academic help are expected to perform better.

3. Slow web access does not impact the frequency of web usage. Does perception of slow access prevent students from going into the web frequently?

4. Problems with hardware and software do not impact the frequency of web access. Do problems associated with hardware and Internet software prevent students from accessing the web frequently?

5. Recognition of Web's value in research does not lead to frequent web access. Do students who appreciate Web's value in research access the web more frequently?

6. Rating of University's Internet Service is not influenced by student's class level. Do students rate Internet service provided by the university influenced by student's class level?

7. Appreciation of Web value in research is not influenced by student's class level. Do students at higher class level appreciate value of the Web more than students at lower class level?

8. Rating of University's Internet and Web Services is not influenced by student's GPA. Do students who have high GPAs appreciate University's service more than students who have lower GPA?

9. Recognition of Web's value in research is not influenced by student's GPA. Do students who have higher GPAs appreciate Web values' more than students who have low GPAs?

Survey Questionnaire

Two brainstorming sessions with students were conducted to produce a list of possible problems that students encountered while using the World Wide Web service provided by the universities on and off campus. The final list of these problems was used to develop the questionnaire. Items in the survey fell into three areas: (1) student academic background and frequency of web access, (2) problems that students faced, and (3) student level of satisfaction. Respondents were asked about the frequency of occurrence of the problems they encountered by selecting one of the five choices: never, rarely, sometimes, usually, and always. They were also

asked to rate their satisfaction level ranging from worst (lowest) to excellent (highest).

Conducting the Study

During the period from the Fall semester 1997 to Spring semester 2000, 317 students of several classes at St. Cloud State University were surveyed. Participants were told in advance that the anonymous survey responses would be confidential. With some motivation to get out of the class early after completion of the survey, all students participated. Data collected were tabulated and analyzed using Statistical Analysis System (SAS) available on the University's VAX computer.

FINDINGS

Analysis of the results showed that the great majority of the respondents (71.7%) are seniors, followed by juniors (21.3%) and graduated students (6%). Nearly sixty nine percent (69%) of the respondents have an average GPA above 3.0. The average number of web accesses per week is 19.48 times.

Overall, the results showed satisfaction in using Internet facilities (Table 1). Sixty percent (60%) of the respondents rated university web services good to excellent and 51 percent gave good to excellent ratings for their research work.

TABLE 1
INTERNET USAGE RESPONSES

Usage	Number of Responses	Percent
Web Services		
Poor or below average	10	3.7
Average	97	35.9
Good	134	49.6
Excellent	29	10.7
Values in doing research		
Poor or below average	24	9.0
Average	115	39.5
Good	114	42.9
Excellent	23	8.6

TABLE 2
FREQUENCY OF REPORTED PROBLEMS

Problems	Frequency	Percentage
Slow Access Speed		
	Rarely or Never	16.2
	Sometimes	40.6
	Always or Usually	43.2
Lack of Color Scanner		
	Rarely or Never	35.2
	Sometimes	29.2
	Always or Usually	35.6
Lack of Image Editor		
	Rarely or Never	30.7
	Sometimes	32.0
	Always or Usually	37.3
Poor Text Editor		
	Rarely or Never	37.4
	Sometimes	32.3
	Always or Usually	29.3
Web Development Language Problems		
	Rarely or Never	21.9
	Sometimes	40.1
	Always or Usually	38.1
Outdated Support Software		
	Rarely or Never	29.3
	Sometimes	41.7
	Always or Usually	29.0
Problem in Upgrading Web Browsers		
	Rarely or Never	30.8
	Sometimes	30.1
	Always or Usually	39.1
Free Speech Limitation		
	Rarely or Never	40.6
	Sometimes	28.2
	Always or Usually	31.2
Problems with FTP		
	Rarely or Never	31.4
	Sometimes	38.3
	Always or Usually	30.4
Slow Network		
	Rarely or Never	18.1
	Sometimes	37.5
	Always or Usually	44.4

Table 2
(continued)

Problems	Frequency	Percentage
Slow CPU		
	Rarely or Never	22.8
	Sometimes	32.7
	Always or Usually	44.5
Slow Modem		
	Rarely or Never	23.4
	Sometimes	30.8
	Always or Usually	45.8
Problems with Search Engines		
	Rarely or Never	41.9
	Sometimes	30.6
	Always or Usually	27.4
Outdated Internet Software		
	Rarely or Never	31.7
	Sometimes	41.8
	Always or Usually	24.5
Not Enough Computers in the Lab		
	Rarely or Never	37.8
	Sometimes	30.4
	Always or Usually	31.7
Crashes		
	Rarely or Never	32.5
	Sometimes	38.5
	Always or Usually	29.0

Despite the generally favorable results, problems in accessing web pages are evident as presented in Table 2. Chief among these are the complaints about the slowness which include high occurrence (always and usually) of problems caused by modem (45.8% of respondents), processor (44.5%), network (44.4%), and total access (43.2%). Other problems cited at always or usually occurrence levels include upgrading web browser to current level (39.1%), language for web page development (38.1%), lack of an image editor such as Photoshop (37.3%), not enough computers available in the labs (31.7%), unable to exercise free speech (31.2%), problems with file transfer facility (30.4%), crashes (29%), outdated support software such as MS Office or Image Editor (29%), poor search engines (27.4%), and outdated Internet software such as Telnet, FTP, etc. (24.5%).

Correlation Analyses

Based on Spearman rank correlation tests of hypotheses, H_0: $r = 0$ (i.e. there is no correlation between pairs of class levels, frequency of weekly accesses, software problems, value of research, etc.) with $p < .05$, this study accepts the some of the above Null hypotheses and finds no correlation between:

1. GPA of students and frequency of web access. There is no significant correlation between web access and academic success of students measured by GPA.

2. GPA and the value of the University's Internet Service. There is no difference in the evaluation of University's Internet service between students having high GPAs and those having low GPAs.

3. GPA and the recognition of the value of Web in research. Students appreciate Web value in research regardless of their level of academic performance.

4. Class level and the appreciation of University's Internet and Web Services.

5. Class level and the appreciation of Web facility in research.

However, at 5% significant level, some of the above Null hypotheses are rejected:

1. Students of higher classes reported less problems with slow network than students of lower class levels network (corr= -.2164, p=.0001, n=313).

2. Students of higher class levels made more access to the network than students of lower levels (corr= 0.14522, p=0.118, n=299).

3. Students who reported less problems with hardware and software access the system more frequently. The rank correlation results between frequency of access and: (1) slow access speed (corr=-0.14604, p=.0125, n=292), (2) File transfer facility (corr= -.13386, p=.0233, n=287), (3) slow network (corr=-.21016, p=.0002, n=300), and (4) slow CPU (corr= -.14003, p=.0165, n=293).

4. Students who made frequent access also complained more problems with free speech caused by limitations imposed by the University and the government (corr=.19937, p=.0008, n=282).

5. Students who made frequent web access reported more problems with the shortage of image scanner (corr=.15312, p=.0100, n=282).

6. Students who appreciate the value of web sites in research work made more frequent access than the students who did not (corr=.15980, p=.0112, n=251).

7. Students with higher overall GPAs reported more frequent problems with outdated and old versions of software (corr=.11842, p=.0401, n=301).

9. Students with higher overall GPAs also complained more problems with free speech caused by limitations imposed the University and the government (corr=.12049, p=.0393, n=293)

10. Students with higher overall GPAs also reported more problems with search engines (corr= .12297, p=.0321, n= 304).

IMPROVING UNIVERSITY'S INTERNET SERVICES

Better Internet hardware, current software, and services are needed to improve the productivity, efficiency, success and satisfaction for student users at University. While class level does not impact the use and appreciation of web technology, frequent problems with web facility and supports seem to discourage students from accessing the web. For the problems with the use of file transfer facility, it is suggested that students should be taught how to use it. The use of file transfer utility requires students to know basic commands, file directory, and options (binary, ASCII). Wrong target directory and options could spell troubles to new students. Furthermore, students of higher GPAs seem to exceed the current capability of software and are likely to find Internet and Web software in the lab outdated. Understanding of free speech limitation imposed by the University and government could be improved by a course in Computer Ethics and Laws. While principles for effective use of application software in the work place and classrooms have been well documented, certain basic, but often overlooked, elements can and should be introduced into Internet services at University. These include improving access speed, faster network, better user training, better tools, electronic commerce capacity, better network and data security, and frequent upgrade of software. Unfortunately, many of the problems such as limitation of search engine capabilities, Web development languages, remote server overload, bugs that caused browser crashes, etc. are beyond the control of University's computing services department.

CONCLUSIONS

This study has confirmed some existing belief, suspicions, and added to some existing knowledge in Web usage in classroom. Better hardware, up-to-date software, training, and services are needed to improve the efficiency, success, learning, and satisfaction for students at St. Cloud State University. Frequent problems with web facility and supports also seem to discourage students from taking advantage of the web capabilities in learning. It is suggested that students should be well trained in Internet and Web facilities before using the University's computer labs for class assignments. Clearly, with the rapid advance in Internet and web technologies, opportunities exist in curriculum development to facilitate and enhance the learning and effectiveness of University's computer services.

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APPENDIX

WWW Survey

All responses are anonymous and confidential.

I. Student's background. Please circle appropriate number or letter.

1. Your class standing: 5: Graduate, 4: Senior, 3: Junior, 2: Sophomore 1: Freshman
2. Number of times you access the Web pages per week _____
3. Your major GPA is about: A:3.5 -4.0, B: 3.0-3.49, C:2.5-2.99, D: 2.0-2.49, E: Below 2.0
4. Your overall GPA is about: A:3.5 -4.0, B: 3.0-3.49, C:2.5-2.99, D: 2.0-2.49, E: Below 2.0

II. Frequencies of problems encountered in your home page development: Please circle A: Always, B:Usually C: Sometimes, D:Rarely, E: never

5. Computer and/or network speed is slow A B C D E
6. Lack of color scanners available caused major problems A B C D E
7. Lack of good software to edit image and convert image type (ie. from JPG type file to GIF or BMP type file) A B C D E
8. Text editor on host computer (Unix) is difficult to use A B C D E
9. Text color is not flexible to be changed A B C D E
10. Language that supports interactive page such as Java or CGI is limited and difficult to use A B C D E
11. Network software is back-versioned and outdated A B C D E
12. Download new version of network access such as Netscape is difficult to connect and takes too much time A B C D E
13. Uploading/downloading text and software from PC to host computer is difficult A B C D E
14. Cannot develop or link web page that is provocative or politically incorrect (ie. problem with free speech) which cause problems in development of quality web page A B C D E

III. Frequencies of problems encountered when accessing other web pages: Please circle A: Always, B:Usually C: Sometimes, D:Rarely, E: never

15. Slow network connecting/transferring data from and to other hosts A B C D E
16. Computer CPU/video used in development is slow (486 CPU 33 MHz or less) A B C D E
17. Connecting modem is slow (14,400 BPS or less) A B C D E
18. Difficult to locate/find target pages (using Yahoo, Webcrawler, etc) A B C D E
19. Software is too outdated (old version) to take advantage of latest web page technology A B C D E
20. Not able to find computer that can access web pages in the computer lab when needed A B C D E
21. Web page crashes during connection/access A B C D E
22. Your evaluation of WWW services available at this university:
    A: Excellent, B: Good, C: Average, D: Below Average, C: Poor
23. Your evaluation of WWW services to help you in research paper:
    A: Excellent, B: Good, C: Average, D: Below Average, C: Poor
24. Please write below other problems that you have in using WWW pages:

    _____

    _____

25. Please write below other problems that you experienced in the development of your own home page:

    _____

    _____

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